UMD PHYS 485 and 685 Syllabus Fall 2020

Professor
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Teaching Assistants
Nathan Zimmerberg. E-Mail: use elms mail.

Course Emphasis
Physics 485/685 are courses in modern electronics with an emphasis on hands-on laboratory work and topics that are useful as career skills.

Equipment kits
During the summer of 2020, we have obtained equipment for each student to borrow for the Physics 485/685 Fall semester. These were obtained by a grant from the Provost' office for pandemic course redesign. The equipment remains campus property. Each student will sign out the kits and return them at the end of the term. A bill to your Bursar account will be sent for unreturned kits (sorry) after the end of the semester finals. You will be able to gather the kits at the Physics maker space (the vortex) rolling door during the first week without needing to come inside. Parking for one vehicle is also available during pick-up. Time slots will allow spacing everyone out. We will discuss the details of this during the first zoom-lecture Monday Aug. 31.

Equipment kits contents (approx. value $200):
1. Nscope USB based digital oscilloscope and function generator, cable, and breadboard
2. Elegoo Arduino Uno Super Starter kit with a USB microcontroller and another 50 or parts
3. Sparkfun VC830L Digital Multimeter
4. One small ziplock bag of a handful of small electronic parts needed for the labs

Blended course details
This course is designed to allow some students to attend in-person lectures (depending on campus status), and some students to attend in-person labs (also depending on campus status). Students will be able to opt-out of in-person experiences; the course can be completed remotely. I will query students via elms during the first week about their preferences (similar to the informal survey I did last month). The course design is done both to accommodate students preferences as well as allow us to carry-on if everyone needs to be remote – such as during the first two weeks of class.
In-person lecture meets Monday and Friday 2-2:50 p.m. in Room CHM 1407.
Remote lecture will be via my zoom channel and will be synchronous with the in-person lecture: https://umd.zoom.us/j/9539295145

There are two laboratory sections each week one on Tuesday and one on Wednesday in Room PHYS 3306 nominally from 1-4:50 p.m. A student ID card swipe is necessary for access to the laboratory area. We will also likely assist in remote laboratory work during those same time periods, possibly using either my or the TAs zoom channel. This will, of course, be a bit of an experiment itself. For students attending in-person labs, we ask that you bring your equipment kit with you to the lab and take it home at the end. We also recommend you bring a laptop. These steps minimize the need for us to clean equipment and your need to touch equipment used by others!

Obviously, for any in-person instruction, campus pandemic rules will be strictly followed, i.e. masks, social distancing, etc. Obviously, as it is 2020, we have no idea how long in-person activities might be possible, but I hope it is longer rather than shorter!

Manuals

Supplied via elms

1) Physics 485/685 Laboratory Experiment Descriptions/assignments: available each week on the course elms page.

Laboratory Notebooks

Each student should maintain a notebook in which all data and descriptive information about each experiment is to be recorded in pen not pencil. The laboratory notebook should have a table of contents on the first page (added to over time) to aid in locating the different experiments. It should be possible to reconstruct the experiment from the information in the laboratory notebook. Errors should be crossed out with a single line rather than erased or obliterated. Often an incorrect calculation or circuit will contain information that can be useful later on. The laboratory experiments are flexible by design allowing students latitude in pursuing individual interests. Descriptions of the experiments are given in the Experiment descriptions along with data sheets for the devices used in the experiments.

PHYS 485/685 Laboratory Reports: Format will be discussed in lecture and the assignments.

Grades

The semester grade for the course will be determined in the following way:

PHYS 485	
Lab reports	60%
Participation in lecture	10%
Homework	15%
Project	15%
PHYS 685	
Lab reports	55%
Participation in lecture	10%
Homework	10%
Project (by design more advanced)	15%
Linkedin page content	10%

LIST OF LABORATORY PROJECTS (spread out over 14 weeks and subject to change as we get used to the new equipment kits)

1) Nscope and multimeter warmup
2) RC Circuits
3) Diodes
4) Arduino initial laboratory
5) Bipolar Junction Transistor
6) Metal Oxide Semiconductor Transistors (MOSFETs)
7) Feedback and Operational Amplifiers
8) IR LED and photodiode sensor
9) Logic gates and ring oscillators
10) Actuators: transistor powered motor
11) Measurement of magnetic field and temperature

PRELIMINARY LECTURE TOPICS

Primary electronics topics	**Principle applications topics**
Intro materials	**Grounds**
Passive electronics LRC	**Thermometry**
Diodes and Hall proves	**Bench instruments and lock-ins**
Diodes 2 and varisters	**Controls**
LED's, photodiodes, and photovoltaics	**PID**
Transistors	**Actuators**
MOSFETS etc	**Vacuum electronics**
Op-amps, precision amps	**AFM, SEM, TEM**
Digital logic	**Microcontrollers**
Microprocessors	**Radio transmission and reception**